DOCUMENT RESUME

ED 251 411 SP 025 378

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TITLE Mathematics Inservice Program in the Province of Taiwan, Republic of China. Its Development, Implementation, and Evaluation.
PUB DATE 28 Aug 84
NOTE 29p.; Paper presented at the International Congress on Mathematical Education (5th, Adelaide, Australia, August 28, 1984).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Curriculum Development; Elementary Education; Elementary School Teachers; Foreign Countries; Government Role; *Inservice Teacher Education; *Mathematics Education; *Mathematics Instruction; *On the Job Training; Program Implementation; Teacher Participation; *Textbook Preparation
IDENTIFIERS *Taiwan

ABSTRACT

The Taiwan Provincial Institute for Elementary School Teachers Inservice Education (IETISE) provides teachers with a place to improve their teaching skills and use new materials. Concentrating on the field of mathematics, a "seed team" training program for elementary school teachers uses the concept of peer training by offering intensive instruction to selected teachers who then return to their schools to train other teachers. One priority of IETISE is the production of mathematics textbooks for elementary school students and accompanying materials, such as student workbooks, teacher resource handbooks, and instructional aids. A description is given of each phase of this developmental program: planning, designing and developing the curriculum, piloting and evaluating, and implementing the program. A curriculum reform, currently in progress for all subjects at the elementary level, is described as well as a similar inservice program for secondary school teachers. These teachers receive most of their training directly through Taiwan Normal University and satellite centers. (JD)

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MATHEMATICS INSERVICE PROGRAM IN THE PROVINCE OF TAIWAN, REPUBLIC OF CHINA

ITS DEVELOPMENT, IMPLEMENTATION, AND EVALUATION*

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*This paper was a portion of the First author's research project, "A Comparative Study of Mathematics Education Between the Province of Taiwan, Republic of China and the United States". It was made possible by a research grant from the PACIFIC CULTURAL FOUNDATION SUBSIDY.

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This paper is a presentation to the Fifth International Congress on Mathematical Education in Adelaide, Australia on August 28, 1984 from 2:00 to 3:30 p.m. in the Theme Group--The Professional Life of Teachers.

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MATHEMATICS IN-SERVICE PROGRAM IN THE PROVINCE OF TAIWAN, REPUBLIC OF CHINA

ITS DEVELOPMENT, IMPLEMENTATION, AND EVALUATION

Ping-Tung Chang
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The In-Service Training Program for mathematics teachers in the Republic of China has long been recognized as one of the finest, most successful, and comprehensive training programs for teachers' on-the-job development anywhere in the world. Its main goals are:

(1) to teach teachers more mathematics. This serves the function of continuing education for the classroom teachers of mathematics.

(2) to teach teachers how to establish a more creative, interesting environment for the learning of mathematics.

(3) to teach teachers the most up-to-date instructional methods.

(4) to teach teachers how to use mathematics to explain life situations to students.

(5) to teach teachers how to use mathematics to solve problems.

(6) to teach teachers how to improve skills and

how to raise professional standards.

(7) to familarize teachers with new curricula and new teaching materials.

(8) to focus teachers' attention on current events related to mathematics.

Two separate organizations are currently providing the in-service training for secondary school mathematics teachers and elementary school teachers. The secondary mathematics teacher in-service training is coordinated by the In-Service Training Center at the National Taiwan Normal University. There are satellite centers, which are the responsibility of the departments of mathematics, at the various teachers' colleges around the island. The elementary school teachers' in-service training program is provided by the Taiwan Provincial Institute for Elementary School Teachers In-Service Education (IETISE).

In-Service Program for Elementary School Teachers

The IETISE is the only organization for on-the-job training of elementary school teachers in Free China. The early mission of this institute was to provide professional training to all unqualified teachers. The reason there were

so many unqualified teachers war that Taiwan was occupied by the Japanese for about fifty years before the Second World War. During this period, most of Taiwan's elementary school teachers (about 80%) were Japanese. After Taiwan was returned to China, the Japanese teachers left and the government of Taiwan had to draft substitute teachers to fill the vacancies. More than 70% of the teachers in Taiwan's school system were unqualified. After the establishment of the Institute in 1956, there were still many teachers who had not received professional training. A survey was conducted in 1961, and it was found that 8000 school teachers had only graduated from senior high school or vocational school. 5000 teachers had only graduated from junior high school. There were more than 800 teachers who had only graduated from elementary school. During this period, the main task of the IETISE was to provide training in education for these teachers.

The curricula of these classes were language, mathematics, social science, and art. The training period was four weeks for each class. By the

end of March, 1975, a total of twenty-five thousand teachers, department chairmen, and principals, completed their training courses at the Institute (Chen, 1975).

The general classes dealt mainly with the subjects taught in elementary school. The special classes trained the people who held special positions, such as principal, department chairman, and early childhood teacher. Hence, the main missions of this Institute were not only for teacher training in education, but also for their continuing education and research.

The purposes of the Institute are to provide teachers a place to improve their teaching skills, to raise their professional standards, to allow them to study curriculum improvement, to learn new instructional techniques, to select teaching materials, to develop problem-solving skills, to learn to offer guidance to students, and to learn how to communicate with students.

Since its establishment in May, 1964, the IETISE has been conducting reserve-training classes for administrators of the elementary schools.

The selection of the reserve-training classes for directors and principals was recently changed from the nomination point system criteria to a qualification examination for all interested active elementary school teachers (Chen, 1975). This means that anyone can be an administrator if he or she passes the examination. This unique feature has produced many well-qualified and dedicated administrators (Chen, 1975).

During the first ten years, the number of trainees in the Reserve Directors and Principals classes were as follows:

May, 1964 ---- March, 1974	
Total Number	3165
Reserve Principals	1163
Reserve Directors	2002

(Source: Chen, M. (1975). SATCA Review)

Another feature of IETISE is the training of inspectors of the elementary schools. The Elementary School Educational Inspecting Team consists of about ten members who are selected from a group of well-qualified experienced teachers. They are divided into several small

units according to their speciality. Besides regular teaching duties, each member contributes one day per week/two weeks to visit other schools and provide assistance to local teachers regarding teaching, curriculum, or other classroom activities relating to the teaching duties in their respective fields. Their visitations are mainly to provide assistance to local teachers, not to evaluate the teaching skills, therefore, the team is received enthusiastically by the local teachers.

IETISE provides one month of training for the inspectors. They receive subject area refresher courses and learn inspection skills and methods of guidance (Chen, 1975).

Another unique feature of the IETISE was the "Seed Team" training program for mathematics. During 1971, new mathematics textbooks were adopted for the elementary school. There were no teachers who could use them efficiently. In order to teach them how to use the books, a seed team training program was begun. Five of

the best qualified teachers from each school district were brought in for a month of intensive training in mathematics. They returned to their districts and held workshops and seminars for all teachers to show them how to teach mathematics. In the school year of 1971, there were 15,000 teachers who received indirect training through the seed team members of IETISE. It was indeed a very successful program (Chen, 1975).

In 1972, a curriculum reform was begun for all the elementary schools. The first projects conducted by the Institute were in the science and mathematics areas. Both were large-scale and long-term projects in nature. Each used the same systematic approach. They involved extensive nationwide pilot studies and comprehensive in-service teacher training.

The most important aspect of the science project was the selection of the best school teachers in the district to participate in this program--the development and research of the elementary school science education in the Republic of China (Tsui, 1982).

First priority of this Institute was the production of mathematics textbooks for grades one through six, and accompanying materials, such as student workbooks, teacher resources handbook, reference books, and instructional aids, etc. The mathematics instructional materials were developed by members of the Math Unit at the Institute and also by members of the Advisor Board of the Math Unit who served as the Review Board to oversee the new materials.

The projects in science and mathematics were carried out in two phases (Tsui, 1982):

(I) PHASE I

(A) Planning Stage: The Research and Development Committee for natural science was established in 1972, followed by the Mathematics Committee in 1974. Both committees consisted of educators, psychologists, curriculum specialists, media experts, experienced school teachers, and prominent professors from different academic disciplines. The major tasks of the Math Committee were to:

(1) Collect data regarding current

mathematics curriculum from local school districts and from foreign countries.

(2) Conduct surveys and conduct interviews.

The results of the analysis of the data and reference materials determined the next stage.

(B) Design Stage:

(1) Set curriculum goals.

(2) Constructed basic curriculum model:

(a) Unit behavioral objectives.

(b) Unit content (selection criteria, organization criteria, structure criteria).

(c) Unit evaluation and its criteria.

(C) Development Stage:

(1) Draft of unit content and learning activities (unit behavioral objectives, teaching methods recommended).

(2) Draft of teacher's edition of the unit.

(3) First draft of student's and teacher's editions of the completed set of texts.

(4) Field testing and evaluation.

(5) Revision and retesting.

(6) Provisional edition ready for pilot study.

(7) Instructional aids designed, produced, and evaluated.

(8) The approved instructional designs manufactured by selected vocational and technical schools around the country. This production program provided technical students hands-on experience and skills.

(D) Pilot and Evaluation Stage: After receiving the approval authorization from the Research and Development Committee, the provisional curricula was piloted, evaluated, and revised three times.

(1) (a) Selected schools for first pilot testing.

(b) First pilot testing by members of the Research and Development Committee.

(c) Evaluation of performance and result of first pilot testing, such as teacher reaction, student reaction, and any unforeseen

problems regarding the new text were brought to the attention of the members of the Editorial Board.

(d) Revised provisional materials.

(2) (a) Selected schools for the extensive second pilot testing using revised text.

(b) Conducted second pilot study.

(i) Selected 48 schools to participate in the project.

(ii) One class in each experimental school did the experiments.

(iii) All the teachers involved in teaching the experimental classes attended three weeks orientation at the Institute to familiarize themselves with the revised text.

(iv) One year experimental study.

(c) After the revised texts were tested

for one year, a questionnaire was distributed to all people concerned to solict their reactions to the second revised text.

(d) An evaluation conference attended by the teachers from the experimental schools was held to analyze the data, as well as the comments from the teachers who had used the second revised text.

(e) Additions, deletions, and refinements were made in the second revision of the proposed new text.

(3) A third pilot testing

(a) 63 new schools were selected for both the natural science and the mathematics projects.

(b) All subject area classes in the participating schools used the second revision of the proposed text.

(c) All the teachers involved in the experimental schools received

three weeks intensive training at the Institute prior to the opening of the school year.

(d) During the one year experiment, teachers received additional guidance and regularly attended demonstration classes provided by the Institute.

(e) By the end of the study, data was collected again. Data on students' performance and attitudes, and teachers' input were collected in order to revise the material for a third time. This was the last revision.

(f) Instructional aids such as workbooks, slides, laboratory kits, and resource books were tested. These tools were distributed to the teachers to use during their training sessions at the Institute.

(E) Implementation Stage:

(1) Full-scale implementation began with

a one-week seminar for mathematics faculty members of all the teachers' colleges in the nation.

(2) All teachers from previous experiments were trained at the Institute again for three weeks.

(3) Teachers from all other schools attended two-week seminars during the summer and winter breaks. These seminars were primarily to teach the teachers how to use the new text.

(4) Teachers received training on how to use some of the instructional aids, such as the audio-visual instruments.

The mathematics project was completed in the Phase I study from 1974-1982.

(II) Phase II

The main purposes of this Phase were:

(1) To insure the implementation of the new text.

(2) To develop suitable instruments for evaluating the performances of the students.

(3) To collect normative data on students'

learning abilities in science and mathematics.

In order to make sure the teachers were actually using the proposed methods and knew how to use the final version of the new texts, as well as the instructional aids, the Institute provided the following assistance and guidance to ensure the proper implementation of the new reformed curriculum.

(A) There were 37 demonstration schools to serve as local centers for dissemination of information regarding the teaching of the new materials.

(B) Members of the Research and Development Committee made periodic visits to local schools to provide assistance and explanations regarding the new curriculum.

(C) Teachers were trained to serve as demonstration leaders.

(D) A PESTSC (Provincial Elementary School

Teachers Service Corps) was established in August, 1983. This corps serves primarily to make regular visits to local schools, to solve problems regarding new curricula, and to give guidance in cooperation with the mathematics supervisors at various levels of the county, city, and provincial departments of education. The corps also serves as a liaison between teachers and the Institute.

(E) In order to make sure the implementation effort reach not only teachers and students in their classes, but other branches of the educational system, such as the elementary school, the teacher colleges, and all the auxiliary service networks, the Institute incorporated three other agents: Department of Education of Counties and Cities, the teachers' colleges, and the newest one, the PESTSC.

(F) Research continues at the Institute on assessment instruments, since the new curriculum emphasizes "learning by doing"

rather than the traditional learning by "teacher talk" and "pencil and paper".

A curriculum reform is currently in progress for all subjects at the elementary level. Reaction to this process has been extremely favorable. Its success is due mainly to the following unique aspects (Tsui, 1983):

(1) The reform movement is currently under government sponsorship. The projects can call upon the best minds and vast manpower to maintain overall high standards and quality control. The standardization of the instructional aids not only reduces expenses, but also makes it easier for teachers to use them more accurately and more efficiently.

(2) The instructional design has progressed hand-in-hand with instructional practice. For example:

(a) Elementary school teachers participate in every stage of the design process in order to give practical experience from actual use of the new text.

(b) Every teacher has been informed that his/her input can be extremely useful for the revision of the final version of the text. Their opinions can be brought out during the evaluation conference after each pilot study or through the questionnaires used during their training sessions.

(3) Every elementary school teacher receives several weeks of intensive training before the adoption of the new materials. After the adoption, the teacher receives training regularly regarding new teaching skills and methods, as well as the new content. In order for the teaching training institutes to incorporate the ideas of the new curriculum, the nine teacher training colleges around the country have been given instructions along with new materials and videotapes to help the professors familarize themselves

with the process and the new curriculum. Every college has 77 videotapes for science teacher education and 30 videotapes for mathematics teacher education.

(4) Instructional media have been developed. The development of audio-visual instruments goes through the following process: research, design, production and testing along with the teaching method, revision, and final product.

(5) The project has been piloted for many years.

(6) The choice of the representative schools for the first testing was carefully made.

(7) The choice of the schools for the second and third pilot studies and demonstration schools was carefully made. The schools are spread throughout Taiwan and over urban, rural, suburban, mountain, and coastal

districts. This diverse representation means that the materials developed have been tested and proven to be suitable for use in all parts of the country.

(8) The curriculum reform in the Republic of China is probably the most economical in the world. For the science and mathematics projects, the cost to produce the instructional aids, teacher's re-education, and the research and development was less than U.S. $5.00 per student.

Table 1 shows the number of teachers and classes during the curriculum reform.

Table 1

Number of Teachers and Classes During the Curriculum Reform

	Year of 1972	Year of 1983
Number of teachers	61,517	70,055
Number of schools	2,349	2,557
Number of classes	49,333	50,715
Number of students	2.4 million	2.2 million
Student/Teacher ratio	40 to 1	31 to 1

(Source: Tsui, G. (1983). Curriculum research development and implementation in elementary school science and mathematics in the Republic of China. Unpublished material.)

In-Service Program for Secondary School Teachers

Similar to the In-Service Program for elementary school teachers, scheduled in-service training courses are offered during the summer semester for mathematics teachers through the In-Service Training Center at the Taiwan Normal University in Taipei, and also through the satellite centers at the teachers' colleges scattered around the island. Of course, teachers receive increment credits that adjust their salaries. The in-service training courses are free and teachers are provided with uniforms and a weekly allowance during regularly scheduled in-service courses.

Besides the center at the National Taiwan Normal University, the other centers are located at National Tsinghua University, National Chengchi University, National Kaosiung Teachers' College, and National Educational College. Secondary school teachers are trained by a rotation system of two to seventeen weeks. The number of participants in each session varies according to the courses that are being taught. Emphasis is placed on teaching methods and teaching materials in order to improve efficiency of teaching.

Table 16 shows the number of secondary

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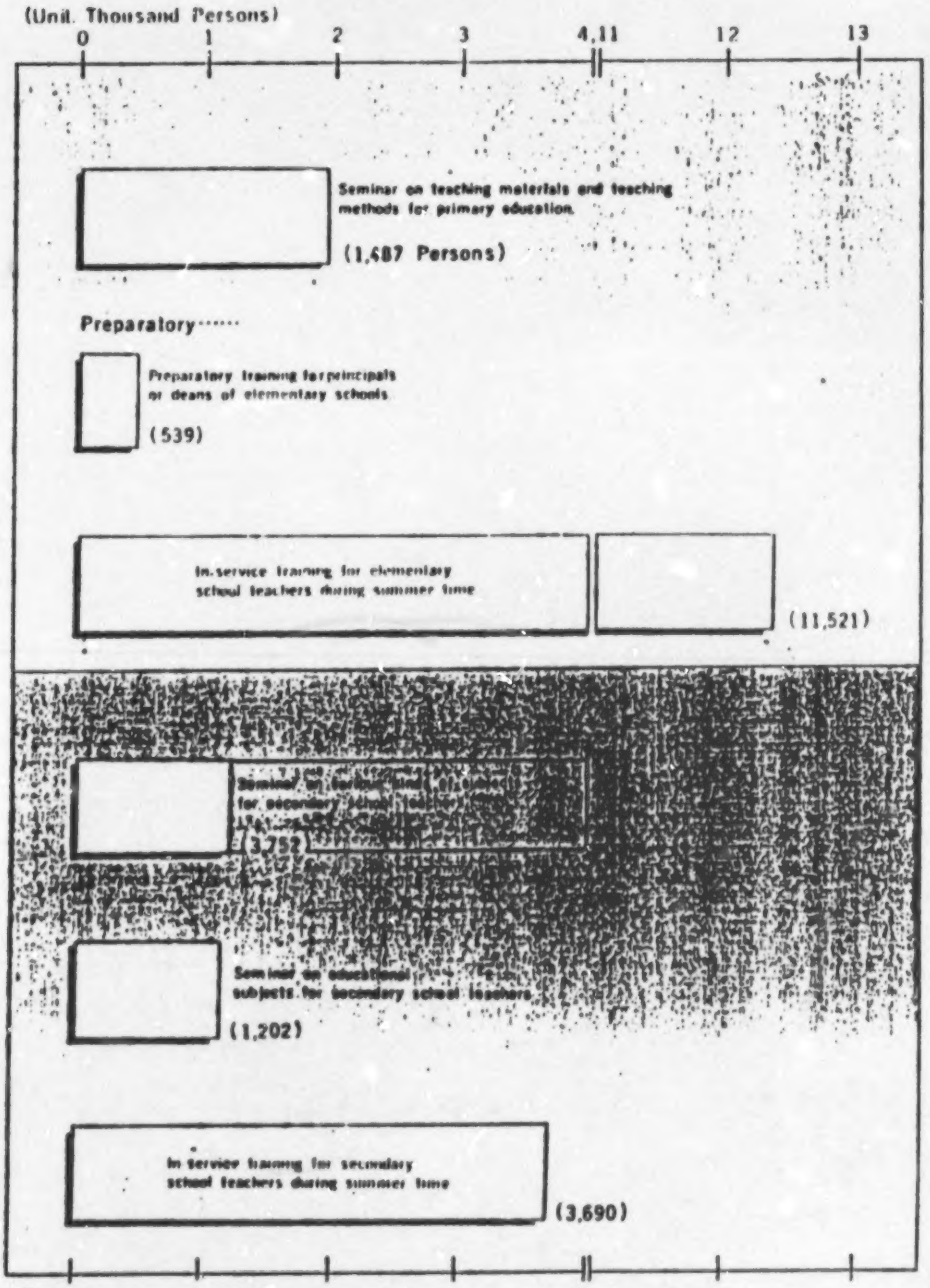
and elementary school teachers having received in-service training during 1982-1983.

Table 2

NUMBER OF SECONDARY AND ELEMENTARY SCHOOL TEACHERS HAVING RECEIVED IN-SERVICE TRAINING SY 1982-83



(Source: Ministry of Education. (1983). Education in the Republic of China.)

Conclusion

The role of mathematics on the eve of a new century will change. Mathematics will increase in value and usefulness. Mathematical literacy will be required for every citizen in order for him/her to maintain a minimum standard of living. Computer-based learning will be realized early in the next decade. Supersonic transportation will shorten the distance between countries, while space explorations will increase human knowledge regarding the mysteries of the universe. With all of these exciting realities in mind, we need to re-evaluate our present school systems, curricula, students' learning styles, teachers' education and the most important task, teachers' retraining education, in order to catch up with the new content of the curriculum.

In most countries, the need for in-service education arose because of today's technological advances. This is a relatively new venture. In England, large-scale in-service activities only started in the late 1960's. And in many countries, in-service activities started later than the 1960's (Sturgess, 1980).

How are teachers supposed to cope with the new curricula and new instructional methods? This is the most important question facing education today. This was also one of the main themes of the Ninth International Conference on Improving University Teaching held in Dublin, Ireland in 1983.

Cooney (1980) at ICME4 suggested that there exists a considerable imbalance between our efforts to study how students learn mathematics and our efforts to study how students' teachers learn how to teach mathematics. He further concluded that if taken seriously,

> "We have a responsibility to reflect upon what that special knowledge is which permits the development of professional mathematics teachers and to consider what processes exist when teachers acquire that knowledge." p. 102-104

Cooney's comments provided a strong foundation of reasoning for the retraining education of mathematics teachers.

Due to science and technological developments, widespread support for emphasizing problem solving will be at the heart of every mathematics course at the secondary level. Perhaps the teacher could introduce a problem whose solution was the material to be taught

next and then show the class how the new knowledge expands their horizons and increases their values in a technological society (Chang, 1983). This form of reinforcement will benefit the student and establish a closer relationship with the teacher. Of course, in-service education will have to train teachers how to teach the processes of problem solving. To increase their effectiveness as problem solvers, teachers will have to work a great deal on their own.

The intense competition of entrance examinations in Taiwan cause teachers to rapidly cover material and devote more time to delivering solutions than to providing information and explanations.

Currently, a curriculum reform is underway at all levels in the Republic of China. A massive retraining program for teachers at all levels is progressing. This reform moreement aims to change the past curriculum which overemphasized abstract rote learning and neglected real life experiences. Without a revolution in education to more adequately meet the needs of the new society, the younger

generation will not be able to survive in the twenty-first century.

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